

## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER OF PATENTS AND TRADEMARKS Washington, D.C. 20231 www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.	
09/927,428	08/09/2001	Wenbing Yun	LBL-IB-1498	6387	
7:	590 02/20/2003				
John P. O'Banion O' BANION & RITCHEY LLP Suite 1550			EXAMINER		
			DEO, DUY VU NGUYEN		
400 Capitol Ma Sacramento, CA		ART UNIT		PAPER NUMBER	
<b></b>			1765	6	
			DATE MAILED: 02/20/2003	Ĵ	

Please find below and/or attached an Office communication concerning this application or proceeding.

			AS	,
•		Application No.	Applicant(s)	_
Office Action Summary		09/927,428	YUN ET AL.	
		Examiner	Art Unit	_
		DuyVu n Deo	1765	
Period fo	The MAILING DATE of this communication app r Reply	ears on the cover sheet with the c	correspondence address	
A SHO THE N - Exten after S - If the - If NO - Failur - Any re	DRTENED STATUTORY PERIOD FOR REPLY MAILING DATE OF THIS COMMUNICATION. sions of time may be available under the provisions of 37 CFR 1.13 (SIX (6) MONTHS from the mailing date of this communication. period for reply specified above is less than thirty (30) days, a reply period for reply is specified above, the maximum statutory period we to reply within the set or extended period for reply will, by statute, eply received by the Office later than three months after the mailing dipatent term adjustment. See 37 CFR 1.704(b).	36(a). In no event, however, may a reply be time within the statutory minimum of thirty (30) day rill apply and will expire SIX (6) MONTHS from cause the application to become ABANDONE	nely filed s will be considered timely. the mailing date of this communication. D (35 U.S.C. § 133).	
1) 🖂	Responsive to communication(s) filed on <u>09 A</u>	uguet 2001		
2a)☐		s action is non-final.		
3)□	Since this application is in condition for allowa		resecution as to the morite is	
,—	closed in accordance with the practice under <i>b</i> on of Claims			
4)🛛	Claim(s) <u>1-80</u> is/are pending in the application.			
4	la) Of the above claim(s) is/are withdraw	n from consideration.		
5) 🔲 (	Claim(s) is/are allowed.			
6)🖾 (	Claim(s) <u>1-80</u> is/are rejected.			
7) 🗌 (	Claim(s) is/are objected to.			
8) <u> </u>	Claim(s) are subject to restriction and/or on Papers	election requirement.		
9) <u></u> ⊤	he specification is objected to by the Examiner			
10) <u></u> ⊤	he drawing(s) filed on is/are: a)□ accept	ted or b)⊡ objected to by the Exar	miner.	
	Applicant may not request that any objection to the	drawing(s) be held in abeyance. Se	ee 37 CFR 1.85(a).	
11)∐ T	he proposed drawing correction filed on	is: a) ☐ approved b) ☐ disappro	ved by the Examiner.	
	If approved, corrected drawings are required in rep	•		
12)[ T	he oath or declaration is objected to by the Exa	ıminer.		
Priority ur	nder 35 U.S.C. §§ 119 and 120			
13) 🗌 🛚 A	Acknowledgment is made of a claim for foreign	priority under 35 U.S.C. § 119(a)	)-(d) or (f).	
a)[_	] All b) ☐ Some * c) ☐ None of:			
1	I. Certified copies of the priority documents	have been received.		
2	2. Certified copies of the priority documents	have been received in Application	on No	
	B. Copies of the certified copies of the priority application from the International Bure the attached detailed Office action for a list o	eau (PCT Rule 17.2(a)).	· ·	
14)∐ Ac	knowledgment is made of a claim for domestic	priority under 35 U.S.C. § 119(e)	) (to a provisional application).	
	☐ The translation of the foreign language provections are translation of the foreign language provections.			
Attachment(s	s)			
2) Notice	of References Cited (PTO-892) of Draftsperson's Patent Drawing Review (PTO-948) ation Disclosure Statement(s) (PTO-1449) Paper No(s) <u>4</u> .		(PTO-413) Paper No(s) atent Application (PTO-152)	
. Patent and Trac	demark Office			_

Art Unit: 1765

## **DETAILED ACTION**

## Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
- (e) the invention was described in-
- (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
- (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).
- 2. Claims 1, 2, 7-11, 16, 18, 23, 28, 29, 34-38, 40, 41, 43, 45, 50, 55, 60, 61, 63, 64, 66, 67, 69, 71, 76 are rejected under 35 U.S.C. 102(b) as being anticipated by Zandveld (US 4,104,085).

Zandveld describes a method for etching a substrate comprising: bombarding the surface of the wafer having a silicon (di)oxide layer with argon ions having energy of at least 20 keV with the depth depending on the ions concentration and energy (claimed irradiating the wafer surface with a charged particle beam of suitable energy) and this would form claimed particle tracks; forming a pattern photoresist on the irradiated wafer surface; etching the wafer with a solution according to the etching pattern (col. 3, line 50-col. 4, line 50; figure 1-5).

Referring to claims 2, 10, 29, 37, 38, 55, 63, 64 figure 2 shows the charged particle beam is of predetermined collimation and at a desired direction (perpendicular) with respect to the wafer surface.

Art Unit: 1765

Referring to claim 9, the argon ions are used for the ion implantation (col. 3, line 64-68). This would read on claimed charged particle beam is produced by removing some or all electron from neutral atoms. Method, such as using an accelerator, to produce such ions are known by one skilled in the art as shown in page 9, line 1-2 of specification.

Referring to claims 13, 40, 66 figure 2 shows that the particle tracks would be formed substantially parallel to each other. Claims 14, 41, 67 do not have patentable weight because it is an optional limitation.

3. Claims 1-4, 7, 8, 10, 14, 16, 18, 28-31, 34, 35, 37, 41, 43, 45, 55-57, 60, 61, 63, 67, 69, 71 are rejected under 35 U.S.C. 102(e) as being anticipated by Liu et al. (US 6,271,127).

Liu describes a method for forming dual damascene comprising: exposing the substrate surface with and electron beam or ion implantation with suitable energy (claimed irradiating the wafer surface with a charged particle beam of suitable energy) and this would form claimed particle tracks with a desired depth and alignment; depositing and developing a resist to form an etching pattern on the wafer (claimed depositing and removing portions of the resist layer to generate an etching pattern on the wafer); etching the wafer according to the etching pattern (col. 7, line 21-44; col. 8, line 20-30).

Referring to claims 2, 10, 29, 37, 55, 63, even though Liu is silent about the charged particle beam is of predetermined collimation and at a desired direction with respect to the wafer surface, the electron beam or ion implantation would have to carry a certain collimation and at a certain direction (claimed predetermined collimation at a desired direction) with respect to the wafer surface. Claims 14, 41, 67 do not have patentable weight because it is an optional limitation.

Art Unit: 1765

Referring to claims 3, 4, the wafer would comprise a negative of a final nanomachined structure for the depositing of metal interconnection (col. 7, line 51-59).

## Claim Rejections - 35 USC § 103

- 4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:
  - (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
- 5. Claims 9, 11, 13, 36, 38, 40, 62, 64, 66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu as applied to claims 1, 10, 28, 37, 55, 63 above, and further in view of Zandveld (US 4, 104,085).

The ion implantation taught by Liu is known to one skilled in the art. Zandveld describes such ion implantation method using argon ions (col. 3, line 64-68). This would read on claimed charged particle beam is produced by removing some or all electron from neutral atoms.

Method, such as using an accelerator, to produce such ions are known by one skilled in the art as shown in page 9, line 1-2 of specification.

Referring to claims 11, 13, 38, 40, 64, 66 figure 2 from Zandveld shows the direction is perpendicular to the wafer surface and the particle tracks formed would be substantially parallel to each other

6. Claims 15, 17, 19-22, 42, 44, 46-49, 68, 70, 72-75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu or Zandveld as applied to claims 1, 28, 55 above, and further in view of Hashimoto et al. (US 4,976,818).

Art Unit: 1765

The process of forming pattern in the photoresist is known to one skilled in the art as describes here by Hashimoto. This process include spin coating, electron beam exposure, and develop in a solvent (col. 2, line 46-54).

Hashimoto also teaches using multi-layer resist system because it improves dry etch resistance and suppress the proximity effect due to reflection of electrons. The multi resist system is processed with dissolution of selective portions of the resist layer using a solvent and a plasma based etching (col. 1, line 18-31; summery; col. 2, line 39-61).

7. Claims 23-25, 50-52, 76-78 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu as applied to claims 1, 28, 55 above, and further in view of applicant's admitted prior art.

Referring to claim 23, Liu is silent about the chemistry being used for etching of the wafer. Method for etching the wafer including an etching solution or plasma is well known to one skilled in the art as described in page 13 of the specification. Therefore, at the time of the invention, using any method will be obvious in order to etch the wafer with a reasonable expectation of success.

8. Claims 5, 6, 26, 27, 32, 33, 53, 54, 58, 59, 79, 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu or Liu/admitted prior art as applied to claims 1, 25, 28, 52, 57, 78 above, and further in view of Chen (US 5, 723,387).

Liu doesn't describe the electroplating method for forming the Cu. Chen teaches an electroplating method for forming Cu interconnects (claims 6, 7). It would have been obvious for one skilled in the art to deposit Cu in light of Chen because Chen teaches that electroplating method can form very small scale Cu interconnects on semiconductor substrate.

Art Unit: 1765

9. Claims 12, 39, 65 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu or

Zandveld as applied to claims 10, 37, and 63 above.

Unlike claimed invention, Liu and Zandveld do not describe the direction of the particle

beam hitting the substrate is of less than 90 degrees with respect to the plane of the wafer

surface. However, the amount of particle beam hitting the wafer surface would depend on the

angle it hits on the wafer; therefore, it would have been obvious for one skilled in the art to

determine the angle the particle beam hitting the wafer surface through routine experimentation

in order to obtain the optimum angle for the wafer surface treatment with a reasonable

expectation of success.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the

subject matter which the applicant regards as his invention.

11. Claims 23, 50, 76 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite

for failing to particularly point out and distinctly claim the subject matter which applicant

regards as the invention.

The limitation "etching pattern...with aspect ratio substantially greater than that in

etching pattern" is vague and unclear to what exactly being compared.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD

February 11, 2003

BENJAMIN L. UTECH SUPERVISORY PATENT EXAMINER

Am 1 s

Page 6

TECHNOLOGY CENTER 1700